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account of the general ecological features and plant products of the island is followed by an interesting "Botanical history," which gives a very full account of botanical work on the island previous to the visit by the author himself. The list is based on Baron Eggers's well-known Flora of St. Croix and the Virgin Islands, 117 species being added. The total flora, as now known, numbers 1,029 species, 992 of which are vascular plants. It is pleasant to note that the author has succeeded in distributing his whole collection under published species, with the single exception of a species of *Cordia*.—J. M. C.

THE FIRST PART of Sargent's *Trees and Shrubs*⁹ has appeared. The general scope of the work may be obtained from the title and from the preliminary announcement made in BOT. GAZ. 34: 388. 1902. Those acquainted with the *Silva* of Professor Sargent will recognize the same general style and arrangement of text and plates, the latter being reproductions of original drawings made by C. E. Faxon, probably the most skilful and experienced botanical draftsman in America. This first part contains descriptions and illustrations of *Juglans mexicana* S. Wats., seven new species of *Crataegus* (*C. durobriensis* Sarg., *C. Laneyi* Sarg., *C. Coleae* Sarg., *C. maloides* Sarg., *C. luculenta* Sarg., *C. fruticosa* Sarg., *C. paludosa* Sarg.), *Eupatorium Loesenerii* Robinson, *Senecio Robinsonianus* Greenm., *Styrax Ramirezii* Greenm., *Faxonanthus Pringlei* Greenm. (a new Mexican genus, singularly described with no statement as to its family), *Ehretia viscosa* Fernald, *Berberis Sieboldi* Miq., *Ilex serrata* Thumb., *Acer capillipes* Maxim., *A. Tschonoskii* Maxim., *Malus Halliana* Koehne, *Viburnum Wrightii* Miq., four new species of *Lonicera* (*L. saccata* Rehd., *L. Koehneana* Rehd., *L. ferruginea* Rehd., *L. arizonica* Rehd.), *L. Griffithii* Hook. f. and Thoms., *Enkianthus subsessilis* Makino.—J. M. C.

NOTES FOR STUDENTS.

MASSART has published a preliminary work¹⁰ on the influence of pollination on the growth of the fruit of Cucurbitaceae. He finds that the initial stimulus to growth is from the pollen, and is perceptible when killed pollen is applied to the stigma. The further growth of the fruit is dependent on a stimulus from the "fertilized ovules," whose transmission is limited, so that cavities are formed when no embryos are formed in some chambers of the fruit.—E.B. COPELAND.

⁹SARGENT, CHARLES SPRAGUE, *Trees and shrubs*, illustrations of new or little known ligneous plants prepared chiefly from material at the Arnold Arboretum of Harvard University. Part I. Boston and New York: Houghton, Mifflin & Co. 1902. \$5. net.

¹⁰MASSART, I., Sur la pollination sous fécondation. Bull. Jard. Bot. État. Bruxelles 1: fasc. 3. pp. 7. 1902.

FREDERIC E. CLEMENTS has published¹¹ a paper entitled "Greek and Latin in biological nomenclature." Its purpose may be expressed in the following quotation: "The following treatise is intended to serve as a compendium of the principles of word-formation in Greek and Latin of sufficient thoroughness to enable the biologist to construct in proper manner any derivative desired. Further than this, various unfortunate usages which have obtained in nomenclature and the many types of malformations will be considered in detail, and suggestions will be made for their correction or elimination."—J. M. C.

FERRARIS¹² has undertaken a morphological study of the Iridaceae, his first paper dealing with *Romulea*. The archesporial cell gives rise to a row of three megaspores, the innermost of which functions. The synergids show a prominent development of the filiform apparatus. The three antipodals become very large and send out beaks into the projection of chalazal tissue that extends into the antipodal extremity of the sac. The sac finally completely replaces the nucellus, the extremity being freely exposed in the micropyle. The remaining phenomena recorded are those common among monocotyledons.—J. M. C.

IN HIS STUDY of the parasitism of *Buckleya Quadriala*, Kusano¹³ reaches the following conclusions: The haustorium is provided with a cambium ring between its cortical and axial parts which joins that of both the host and the mother-root; the form and structure of the haustorium change with age; it possesses medullary rays, but the existence of sieve tubes could not be determined definitely; the sucker, easily distinguishable in the younger stage, loses its distinctiveness from the part behind after a certain amount of growth; as long as the host root is alive the haustorium may be active and can maintain its life during many years.—J. M. C.

A PAPER by Neubert¹⁴ on the nutations of the cotyledon of *Allium* comes to these conclusions: (1) the formation of the characteristic knee is automatic, though influenced by negative geotropism and the consistency of the earth; (2) the elimination of the curve is also chiefly automatic, but here too gravity has some directive influence; (3) the formation of the protuberance on the knee is dependent on darkness and friction. Neubert seems not to know of the existence of my work on the geotropism of these cotyledons,¹⁵ nor of

¹¹ University Studies, Univ. Nebr. 3: 1-86. 1902.

¹²FERRARIS, TEODORO, Ricerche embriologiche sulle Iridacee. I. Embriologia del G. *Romulea* Maratti. Ann. R. Istit. Bot. Roma 9: 221-241. pls. 6-7. 1902.

¹³KUSANO, S., Studies on the parasitism of *Buckleya Quadriala* B. et H., a santalaceous parasite, and on the structure of its haustorium. Jour. Coll. Sci. Imp. Univ. Tokyo 17: article 10, pp. 42. pl. 1. 1902.

¹⁴NEUBERT, R., Untersuchungen über die Nutationskrümmungen des Keimblattes von *Allium*. Jahrb. Wiss. Bot. 38: 119-145. 1902.

¹⁵COPELAND, E. B., Positive geotropism in the hypocotyl or cotyledon. BOT. GAZ. 31: 410-421. 1901.

Noll's fine work on *Cucurbita*,¹⁶ which in essentials antedates about all that might otherwise be novel or valuable in this paper from the Leipzig laboratory.—E. B. COPELAND.

HARTLEY,¹⁷ in studying the effects of premature pollination in tobacco, cotton, and tomato, has reached the following definite conclusions: "that the application of good tobacco pollen to immature tobacco pistils causes the flowers so treated to fall from the plant because of the growth of pollen tubes into their ovaries; that tobacco and tomato plants sometimes set and ripen fruits without the flowers having received any pollen, and that such fruits contain no germinative seeds; and that but few fruits will be obtained by the pollination of immature cotton and tomato pistils, but that good percentages may be obtained if the pollination is performed when the pistils are receptive."—J. M. C.

IN A SHORT PAPER on the controlling factors in the direction of branch growth, Wiesner¹⁸ suggests that the position of lateral branches may be a resultant due to the action of negative geotropism on the one hand and to epinasty on the other. As the intensity of epinasty varies with age in some forms, changes in direction which occur as a branch matures may often be explained on this ground, the intensity of negative geotropism being constant as long as growth continues. Since practically nothing is known as to the true nature of epinasty, and since quantitative measurement of geotropic reaction is at least very difficult, it seems to us that such conclusions as the above can be of little avail in advancing true physiology.—BURTON E. LIVINGSTON.

WEISS¹⁹ has elucidated in an interesting way the structure of the tracheary branches first described by Renault as occurring in stigmarian rootlets. He shows that these tracheary strands occur in typical monarchous rootlets. They run from the protoxylem group across the generally lacunar middle cortex of the root and end in a special organ composed of large tracheary elements in the outer cortex. On account of the absence of dichotomy, he draws the conclusion that they cannot be strands belonging to branch-rootlets, but rather represent special water-absorbing organs rendered necessary on account of the usually almost complete separation of the central cylinder of the stigmarian rootlet from the outer cortex.—E. C. JEFFREY.

¹⁶NOLL, F., Zur Keimungsphysiologie der Cucurbitaceen. Landw. Jahrb. Ergänzungsband I. 1901.

¹⁷HARTLEY, CHARLES P., injurious effects of premature pollination. Bull. 22. Bureau of Plant Industry, U. S. Department of Agriculture. Oct. 4. 1902.

¹⁸WIESNER, J., Regulierung der Zweigrichtung durch "variable Epinastie." Ber. Deutsch. Bot. Gesell. 20: 321-327. 1902.

¹⁹WEISS, F. E., The vascular branches of stigmarian rootlets. Ann. Botany 16: 559-574. pl. 26. 1902.

KRAEMER,²⁰ in his study of the structure of the starch grain and the cell-wall, has discovered that certain appearances described by various authors as indicating a continuity of protoplasm are due to a peculiarity in the structure of the cell-wall, which is made manifest by the reagents employed, and which resembles the structure of the starch grain. He also calls attention to the fact that investigators have generally fallen into the error of supposing that a certain aniline dye could be regarded as a differential stain for protoplasm, whereas the fact is that many colloidal carbohydrates, as mucilage and pectin, and oils and other substances as well, take up these stains. If the substance in the cell-wall which takes up the stain is protoplasm, what is it in the starch grain?—J. M. C.

STORER²¹ adds very materially to our knowledge of mannan as a stored food-stuff in plants by a series of notes on the detection of its hydrolysis product, mannose. A long experience in the study of these substances gives him the right to speak authoritatively on the methods best adapted to their identification and estimation. The methods are clearly described and the difficulties fully discussed. He finds abundance of mannan in the following plant tissues: date stones, ivory nut, flesh of ripe cocoanut, seeds of *Trifolium repens*, and the wood of *Pinus Strobus*, *P. rigida*, *Picea excelsa*, *Larix leptolepis*, *Tsuga canadensis*, *Juniperus virginiana*, and *Chamaecyparis sphaeroidea*. Smaller amounts of mannan are contained in a number of other tissues tested.—BURTON E. LIVINGSTON.

UNDERWOOD²² has given a surprising account of the genus *Gymnogramme* as presented in Hooker's *Synopsis Filicum*. So far from being a natural assemblage, it contains among its species a number of generic groups, several of which bear no close phylogenetic relations to the others or to each other, some even belonging to different tribes. Some of these genera submerged under *Gymnogramme* are related to the Polypodiaceae, others to the Aspidiaceae, one possibly to the Vittariaceae, but more are distinctly related to the Asplenieae. The name *Gymnogramme* being a typonym of the monotypic *Gymnopteris*, established thirteen years earlier, disappears from botanical nomenclature. The two species occurring within the limits of the United States heretofore referred to *Gymnogramme* represent two distinct genera, *Ceropteris* Link and *Bommeria* Fourn.—J. M. C.

MENDEL²³ has investigated the products formed by the action of papain, the proteolytic enzyme of the fruit of *Carica papaya*, upon proteids, with the

²⁰ KRAEMER, HENRY, On the continuity of protoplasm. Proc. Amer. Phil. Soc. 41: 174-180. pls. 21-22. 1902.

²¹ STORER, F. H., Testing for mannose. Bull. Bussey Inst. 3: 13-45. 1902.

²² UNDERWOOD, L. M., American ferns. IV. The genus *Gymnogramme* of the *Synopsis Filicum*. Bull. Tor. Bot. Club 29: 617-634. 1902.

²³ MENDEL, L. B., Observations on vegetable proteolytic enzymes, with special reference to papain. Am. Jour. Med. Sci. pp. 9. (Aug.) 1902.

following results: Papain is active in both acid and alkaline media, forming caseoses and casein peptones which closely resemble these bodies as they are produced in gastric digestion. Thus this enzyme is like pepsin as to the products of its action, but unlike it in that pepsin cannot act in an alkaline medium. Trypsin, as is well known, develops its action in an alkaline medium as well as in an acid one, but its products are quite different from those of pepsin, being mainly leucin, tyrosin, and tryptophan, none of which were found among the products of papain digestion. Mendel concludes, therefore, that papain must be regarded as belonging to a class quite distinct from that of either pepsin or trypsin.—BURTON E. LIVINGSTON.

PALLADIN²⁴ has added to his former researches concerning the generation of chlorophyll in etiolated leaves. He had already shown that such leaves, when cut and exposed to sunlight, fail to become green unless they contain carbohydrate material or are supplied with it from a solution into which they dip.²⁵ Moreover, not only can solutions of saccharose and glucose bring about this effect, but other carbohydrates are also available, *e. g.*, raffinose, fructose, maltose, and even glycerin.²⁶ In the present study he has been able to show that the formation of chlorophyll in such leaves depends upon the concentration of the solution, which may be either too weak or too strong to produce the response. The optimum greening is in a medium concentration. That strong solutions of saccharose can inhibit greening is explained by the fact that they greatly retard oxidation; the process of chlorophyll formation is known to be, at least in part, one of oxidation.—BURTON E. LIVINGSTON.

IN THE FOURTH of his studies on the genus *Selaginella*, Harvey-Gibson²⁷ discusses the anatomy and development of the root. He concludes that the so-called rhizophores which are characteristic of certain species of *Selaginella* do not possess the morphological value of caulomes, but are merely the aerial portions of roots. He points out their close relation to branches, a correlation which, by the way, presents a striking parallel to the condition found in *Equisetum* and the other *Lycopsidea*. The author suggests that, in those cases where a leafy branch grows out from the situs of a rhizophore, there is really present a branch-root combination in which the root has been suppressed. The internal structure of the typical root and the rhizophore is the same, both being monarchous and possessing a well-marked endodermis. The xylem of the root is generally perixylic, but in the rhizophoric portions

²⁴ PALLADIN, W., Einfluss der concentration der Lösungen auf die Chlorophyllbildung in etiolirten Blättern. *Ber. Deutsch. Bot. Gesell.* 20: 224–228. 1902.

²⁵ PALLADIN, W., Ergrünen und Wachsthum der Etiolirten Blätter. *Ber. Deutsch. Bot. Gesell.* 9: 429. 1891.

²⁶ PALLADIN, W., Recherches sur la formation de la chlorophylle dans des plantes. *Rev. Gén. Bot.* 9: 385. 1891.

²⁷ HARVEY-GIBSON, R. J., Contributions towards a knowledge of the anatomy of the genus *Selaginella*. *Ann. Botany* 16: 449–466. *pls.* 20–21. 1902.

of the root in *S. Krausiana*, *S. delicatissima*, and *S. Poulterii*, it is centroylic.—E. C. JEFFREY.

TREUB²⁸ has concluded that *Ficus hirta* produces parthenogenetic embryos, and that this may be true of all the species of *Ficus*. Although pollen grains on the stigma were observed to put out tubes, no tubes could be found penetrating toward the sac or within the sac; and yet there was an abundance of developing embryos, from the undivided egg to a many-celled stage. Treub supports this argument for parthenogenesis by the feeble development of endosperm, and the poorly organized egg apparatus, especially the synergids; but neither point seems to be well taken. In fact, the evidence of parthenogenesis in this case is the repeated failure to find any trace of pollen tubes where they ought to be in case fertilization occurs. The suggestion is made that the stimulus to segmentation in this case is the puncture of the pollinating Blastophaga. Since there are only three recorded cases of parthenogenesis among angiosperms, there is no reason why the author should mention Juel's *Antennaria* and Murbeck's *Alchemilla* and omit Overton's *Thalictrum*.—J. M. C.

SHOEMAKER²⁹ has obtained some interesting results from a study of *Hamamelis virginiana*. In each anther two sporangia appear instead of the usual four, and dehiscence is by means of a door-like valve hinged on the side towards the carpel. The pollen grains show great resistance to low temperature; some were observed to send out tubes after a week of cold weather during which the temperature was at times as low as -15° . Perhaps the most interesting fact is the long period between pollination and fertilization, putting *Hamamelis* in a category with the Amentiferae in this regard. Pollination occurs from October to December; and the tubes at once enter the nucellus and grow rapidly until cold weather. Live tubes were found in January and February safely embedded in the hairy part of the carpel. In the spring growth is resumed and fertilization occurs about the middle of May, five to seven months after pollination. The endosperm nucleus begins to divide after fertilization, and walls begin to appear at about the 12-nucleate stage, the walls appearing first at the bottom of the sac.—J. M. C.

MASSART³⁰ has issued reprints of three papers on irritability. The first and longest deals with positions of equilibrium toward stimuli acting alone or together. Massart assumes an actual or possible transmission of a stimulus in many cases where it has yet to be demonstrated; the same experiments as

²⁸TREUB, M., L'organe femelle at l'embryogénèse dans le *Ficus hirta* Vahl. Ann. Jard. Bot. Buitenzorg II. 3:124-157. pls. 16-25. 1902.

²⁹SHOEMAKER, D. N., Notes on the development of *Hamamelis virginiana* L. Johns Hopkins Univ. Circ. 21: 86-87. 1902.

³⁰MASSART, I., Sur l'irritabilité des plants supérieures. I, II, III. Acad. Belgium Mém. Cour. et autres Mém. 62: reprint, 60 pp. 1902.

many of his satisfied the reviewer³¹ that no transmission occurs. Massart's method of experiment deserves imitation; his cultures were photographed at intervals on the same plate, without moving the camera. For the many individual results the paper must of course be read, but it may be noted here that stems and roots were found most irritable geotropically when horizontal. In the second paper it is shown that the secondary thickening of stems and nourishing roots of *Ficus* species climbing by clinging roots is localized on the less illuminated side. In Massart's terminology this is cataphotanisopachynosis, which tells the story "in a word." Several other instances of unequal thickening (anisopachynosis) are described and figured. The third paper treats of the aerial roots of *Ficus*. There are three kinds, and the geo-, photo-, and haptoneism (origin) and -tropism of each is described.—E. B. COPELAND.

PURE CULTURES of *Stichococcus bacillaris* have been again obtained by Matruchot and Molliard,³² who have carried on some rather extensive experiments upon this alga when grown in various media. Although it does not need large amounts of oxygen for its development, it is not a true anaerobe. The glucoses appear to be the best food tested; dextrine, gum, glycerin, and mannite are all foods, but not as available as the glucoses; while the saccharoses (cane sugar, lactose, maltose) are hardly available at all. Salts of ammonium are foods, but nitrates are not assimilated. Several different concentrations of glucose and saccharose were tested. In stronger solutions the short diameter of the cells is diminished, the cells thus becoming somewhat longer in proportion to their width. It is to be regretted that the authors persist in the use of the percentage system in making up their solutions, and that they have made no observations on the influence of osmotic pressure *per se*. The plant develops normally in the dark. Some studies on the changes in the nucleus according to the culture medium were also made. Careful *quantitative* work in such researches as this would probably advance our knowledge of physiology much more rapidly than this sort of qualitative observation.—BURTON E. LIVINGSTON.

THE DEVELOPMENT of swarm-spores in *Hydrodictyon* is described in great detail in a recent paper by Timberlake.³³ The nucleus resembles that of the higher plants in the behavior of its chromatin, and also in having a well-defined nuclear membrane and a nucleolus. The spindle is bipolar, and at the poles there are sharply defined bodies which the writer interprets—and doubtless correctly—as centrosomes. When spores are about to be formed, a progressive cleavage takes place in the multinucleate protoplasm until the

³¹ BOT. GAZ. 29: 187-188. 1900.

³² MATRUCHOT, L. et MOLLIARD M., Variations d'une algue verte sous l'influence du milieu nutritif. Rev. Gen. Bot. 40: 114-130, 254-268, 316-332. 1902.

³³ TIMBERLAKE, H. G., Development and structure of the swarm-spores of *Hydrodictyon*. Trans. Wis. Acad. Sci. 13: 486-522. *pls.* 29-30. 1902.

protoplasm becomes segmented into small portions, each containing a single nucleus. This segmentation is radically different from that which takes place in the endosperm of higher plants. It is entirely independent of nuclear divisions, and is accomplished by pairs of furrows pushing into the protoplasm from opposite directions, and not by intraplasmic vacuoles as described by Klebs. The spores have two cilia attached to a small, deeply staining granule just beneath the plasma membrane. It is too early even to suggest that this granule may be homologous with the blepharoplast of higher forms. Two delicate threads connect the granule with the nucleus. The cilia themselves stain like spindle fibers. After the spores come to rest, the pyrenoid, which disappears at the beginning of segmentation, again becomes visible. There is no organized chromatophore.—C. J. CHAMBERLAIN.

VALUABLE ADDITIONS to our knowledge of the process of respiration are outlined by Kostytschew³⁴ in a preliminary paper from the St. Petersburg laboratory. He has studied the effect of the nutrient medium upon intramolecular respiration in *Mucor stolonifer* and *Aspergillus niger*. The plants were grown in chambers closed from the air, through which a stream of pure nitrogen was passed during the entire experiment. The intensity of intramolecular respiration is measured in terms of the amount of CO₂ given off per gram of dry substance. Some of the results of the study are as follows: Intramolecular respiration occurs in pure water and in a variety of organic substances. In sugar, peptone, and acetates the intensity of the process is greater than in pure water, while in glycerin, free acetic acid, and quinic acid it equals or falls below that in water. In solutions of acetates *Mucor stolonifer* produces much oxalic acid, but in sugar solutions this substance is almost wholly lacking. Presence of zinc salts increases the amount of oxalic acid produced by *Aspergillus*. Low concentrations of the medium give greater respiratory intensity than higher ones, the optimum concentration being about two per cent. The author believes the last to be a purely osmotic effect, but the molecular weights of the substances used are so different that it is difficult to consider this proved until it is tested with solutions made up by modern methods.—BURTON E. LIVINGSTON.

DICOTYLEDONS with only one cotyledon still offer a problem to be solved. The latest paper on the subject deals with several of these so-called "pseudomonocotyledons."³⁵ The "pseudomonocotyledons" studied were *Eranthis hiemalis*, *Corydalis cava*, *Ranunculus Ficaria*, and *Bunium (Carum) Bulbocastanum*. *Corydalis nobilis* and *C. lutea*, forms which always have two cotyledons, were studied for comparison. *Cyclamen persicum* was also studied on account of its first leaf, which has sometimes been mistaken for a

³⁴KOSTYTSCHEW, S. Der Einfluss des Substrates auf die anaerobe Athmung der Schimmelpilze. Ber. Deutsch. Bot. Gesell. 20: 327-334. 1902.

³⁵SCHMID, B., Beiträge zur Embryo-Entwicklung einiger Dicotyledonen. Bot. Zeit. 60: 207-230. pls. 8-10. 1902.

cotyledon. In *Ranunculus Ficaria* there is hardly a trace of a second cotyledon. In *Corydalis cava* the prominent cotyledon gradually assumes a terminal position, causing a displacement of the stem tip so that it appears lateral. Occasionally there is a slight protuberance which might or might not be the rudiment of the other cotyledon. In *Bunium* also it was doubtful whether a slight protuberance might be interpreted as the rudiment of the missing cotyledon. In *Cyclamen persicum* embryos in the ripe seed show no trace of a second cotyledon. Attempts to induce the development of the missing cotyledon by removing the prominent one gave only negative results. The paper would doubtless have been more complete had it not been for the early death of the writer. The experimental part certainly deserves another trial. *Bunium*, which Schmid regarded as the form most favorable for experiment, was not investigated, because material in the proper stages was not available.—C. J. CHAMBERLAIN.

IN A RECENT SERIES of experiments upon the influence of diminished atmospheric pressure upon the photosynthetic process, Friedel³⁶ has discovered a curious condition of affairs. Young leaves of *Euonymus japonicus*, *Ruscus aculeatus*, and *Ligustrum japonicum*, and entire plants of *Lepidium sativum* were used. A diminution in atmospheric pressure produces first a decrease in the intensity of photosynthesis; then this intensity passes through a minimum, increases again to a maximum, and at last decreases to zero when a pressure of about one-tenth of an atmosphere has been reached. The minimum is from 0.4 to 0.6 of the normal intensity and is reached at a pressure between 0.4 and 0.5 of the normal atmospheric pressure. The maximum intensity (in *Ruscus* it is more than double the normal, in *Ligustrum* it is 0.7 of the normal) is reached at a pressure of 0.14 to 0.22 atmosphere. The author presents evidence that this is due to the joint action of two causes: (1) a decrease in the partial pressure of CO₂ brings about a fall in the intensity of photosynthesis, while (2) a decrease in the total atmospheric pressure occasions a rise. Changes in the partial pressure of oxygen alone have no effect. Also, an increase in the volume of the air in the experiment chamber causes a rise in photosynthetic activity. What may be the exact meaning of these facts it is impossible to conjecture. Perhaps these facts have some connection with the reputedly greater photosynthetic activity of alpine plants as compared with that of lowland forms.—BURTON E. LIVINGSTON.

MCKENNEY³⁷ has been conducting experiments upon the conditions of light production in luminous bacteria. His own summary of the chief results is as follows: (1) all acids are injurious to light production; a slight excess

³⁶ FRIEDEL, JEAN, L'assimilation chlorophyllienne aux pressions inférieures à la pression atmosphérique. *Rev. Gen. Bot.* 40: 337-355, 369-390. 1902.

³⁷ MCKENNEY, R. E. B., Observations on the conditions of light production in luminous bacteria. *Proc. Biol. Soc. Washington* 15: 213-234. 1902.

of alkali is even more injurious than a slight excess of an acid ; (2) the temperature limits for light emission are within those necessary for growth ; (3) change of temperature, either sudden or gradual, is without effect on luminescence, i. e., does not stimulate ; (4) there is no luminescence at or below 0° ; (5) exposures to temperatures above the growth maximum are highly injurious to the power of light production, while exposure to very low temperatures seems to serve as a stimulus to light production ; (6) *Bacillus phosphorescens* is capable of adapting itself to high temperatures, producing a race capable of light production at 35°, which is 5° above the normal maximum for luminescence ; (7) a certain degree of continued illumination is without effect, and it is possible for the bacteria to live their entire lives in the dark and yet emit a brilliant light ; (8) ether acts as a narcotic, preventing luminescence, but not growth and multiplication ; (9) it is possible to develop a race of bacteria so immune to the action of small amounts of ether as to be still luminous in its presence ; (10) peptone or related protein is required for the nutrition of luminous bacteria ; (11) dextrose and certain of the higher sugars may be utilized advantageously by *B. phosphorescens* ; (12) either sodium or magnesium is required for growth, and especially for light production ; minimum, maximum, and optimum amounts of sodium are observed for growth and luminescence ; (13) potassium, ammonium, lithium, rubidium, calcium, barium, and strontium cannot replace sodium (or magnesium).—J. M. C.

STRASBURGER³⁸ has recently published a very complete account of the morphology and biology of *Ceratophyllum submersum*, and has made this work the occasion for some interesting and important remarks upon phylogeny. As is well known, the pollen is discharged and pollination takes place under water. The anthers ripen in succession and an enormous quantity of pollen is produced, so that, in spite of the inevitable loss, most of the ovules produce seeds. The embryo sac shows nothing unusual in its structure. Double fertilization was observed and the chromosomes, twelve in the gametophyte and twenty-four in the sporophyte, were counted. The formation of the endosperm is peculiar. At the first division of the endosperm nucleus a transverse wall is formed, dividing the sac into two chambers, of which the one nearest the chalaza does not divide again ; the other divides, and here again only the cell next the micropyle divides again. This method continues for a few divisions, and then walls are formed in three planes, giving rise to a small-celled tissue near the embryo, and a filament of a single row of cells at the chalazal end of the sac. In early stages the embryo is spherical, and there is no suspensor. At a later stage the embryo bears a striking resemblance to that of *Nelumbo* which Lyon described as having but one cotyledon and a lateral stem tip. Strasburger finds two cotyledons in Cera-

³⁸STRASBURGER, E., Ein Beitrag zur Kenntniss von *Ceratophyllum submersum* und phylogenetische Erörterungen. Jahrb. Wiss. Bot. 37: 477-526. pls. 9-11. 1902.

tophyllum, and after examining *Nelumbo* decides that here also there are two cotyledons, and that the apparently lateral origin of the stem tip is due to displacement. In *Ceratophyllum* not even the rudiment of a primary root is formed. The absence of a differentiated tissue in the cotyledon Lyon regards as a character not found in dicotyledons. The same structure appears in *Ceratophyllum* and Strasburger believes it is due to the fact that there is no primary root, the first functioning root coming from the stem above the cotyledon, practically the same condition as in *Nelumbo*; for, while *Nelumbo* has the rudiment of a primary root, it does not function, the first functional roots appearing as in *Ceratophyllum*. This, like the general reduction of the vascular system is regarded as an extreme adaptation to the water habit. Through such extreme adaptation the specific characters which indicate the place of the plant in the natural system are often obscured or even suppressed.

The latter part of the paper is devoted to a discussion of homology and phylogeny. Nothing but a careful reading of the entire paper could give an adequate idea of the views presented, but a few points may be mentioned. In establishing a natural system of organisms morphology will constantly be the guide, while to physiology will fall the task of clearing up the causes of influences, and of bringing definite forms and structures into relation to function. Natural selection has been overestimated; its function appears to be only that of removing the less valuable forms provided by mutation and direct influence. As Hertwig says, there are many cases in which the sequence of stages in ontogenetic development are caused by general laws of the development of living substance, but in many cases, like the water ferns, recapitulation is evident.—C. J. CHAMBERLAIN.

ITEMS OF TAXONOMIC INTEREST are as follows: M. L. FERNALD (*Rhodora* 4: 213-216. 1902) has described a new variety (*obtusifolia*) of *Glaux maritima*.—PH. VAN TIEGHEM (*Jour. Botanique* 16: 289-291. 1902) has described another new genus (*Periblepharis*) of Luxembourgiaceae.—L. M. UNDERWOOD (*Torrey* 2: 172-173. 1902) has described 2 new species of *Selaginella* from North Carolina.—E. L. GREENE (*Pittonia* 5: 57-106. 1902), in a fascicle of new Compositae, has described new species of *Gaillardia* (2), *Laciniaria* (2), *Erigeron* (2), and *Chrysothamnus* (12); has described 5 new species of *Apocynum* and 10 new species of *Eriogonum*; has revised the genus *Euthamia* to include 14 new species; has described 15 new species of *Monardella*, and 15 new species of *Viola*.—THEO. HOLM (*Am. Jour. Sci.* IV. 14: 417-425. 1902) has described 3 new segregates of *Carex Tolmiei* Boott.—C. V. PIPER (*Bull. Torr. Bot. Club* 29: 642-646. 1902), in his seventh paper on new and noteworthy northwestern plants, has described new species of *Lupinus*, *Arctostaphylos*, *Phlox*, *Allocarya*, *Mertensia*, *Lonicera*, and *Aster* (5).—In the publication of the Chinese *Plantae Bodinierianae*, MM. LÉVEILLÉ and EUG. VANIOT (*Bull. Acad. Internat. Géog. Bot.* 11: 338-344. 1902) have

described 5 new species of *Polygonum*, and EUG. VANIOT (*idem* 345-351) has described 8 new species of *Senecio*.—In a fourth paper entitled "Descriptions of American Uredineae," J. C. ARTHUR and E. W. D. HOLWAY (Bull. Lab. Nat. Hist. Univ. Iowa 5: 311-334. *pls.* 1-9. 1902) have presented the American rusts upon Agrostideae and Chlorideae, including 16 species, one of which is new. In only one species (*P. fraxinata*) is the full cycle of development traced.—C. S. SARGENT (Trees and shrubs, Part I. 1902) has published descriptions of 7 new species of *Crataegus*, a new Mexican genus (*Faxonanthus*, family not stated) by Greenman, a new *Ehretia* by Fernald, and 4 new species of *Lonicera* by Rehder.—A. ENGLER (Bot. Jahrb. 36: 1-208. 1902), in his 24th contribution to the flora of Africa, has published an account of the plankton (Cyanophyceae and Chlorophyceae) of Nyassa and of other African lakes, by W. SCHMIDLE; a new genus (*Cycloschizon*) of Hysteriaceae by P. HENNINGS; 9 new species of *Panicum* by R. PILGER; 32 new species of Orchidaceae by F. KRÄNZLIN; a revision of Dichapetalaceae (24 n. spp.) by A. ENGLER and W. RUHLAND; a revision of Lentibulariaceae (51 species, including 10 n. spp. of *Utricularia*) by F. KAMIENSKI; a second paper on Moraceae (12 n. spp.), Urticaceae (14 n. spp.), Proteaceae (3 n. spp.), Violaceae (23 n. spp. of *Rinorea*), all by A. ENGLER; a third paper on Leguminosae (44 n. spp., the new genera being *Pseudoprosopis*, *Bussea*, *Dicraeopetalum*, *Pseudocadia*, and *Adenodolichos*) by H. HARMS; a second paper on Araliaceae (1 n. sp.) by H. HARMS; a sixth paper on Acanthaceae (21 n. spp.) by G. LINDAU; Dilleniaceae (7 n. spp.) by E. GILG; and the beginning of Capparidaceae by E. GILG.—A. ZAHLBRUCKNER (Beih. Bot. Centrbl. 13: 11-163. 1902) has described 10 new Californian lichens collected by Dr. H. E. Hasse of Los Angeles, among them a new genus (*Hassea*).—I. URBAN (Symbolae Antillanae 3: 280-352. 1902), in describing 56 new species of West Indian plants, has established new genera in Euphorbiaceae (*Chaenotheca*), Rhamnaceae (*Krugiodendron*), and Bombacaceae (*Neobuchia*).—F. STEPHANI (Bull. Herb. Boiss. II. 2: 969-987. 1902) has described 16 new species of *Plagiochila* from Africa.—F. N. WILLIAMS (*idem* 1019-1021) has discovered that the puzzling Mexican *Abasoloa Ta-boarda* Llave & Lexarza is *Sabazia Michoacana* Robinson.—J. M. C.

RECENT TERATOLOGICAL LITERATURE.—DE CANDOLLE³⁹ presents a second contribution to our knowledge of the ascidia of *Ficus*, basing his observations on living material from the Botanical Gardens at Calcutta, where there are two young trees grown from cuttings from an older tree in the vicinity of Calcutta. The leaves of these trees he designates as hypoascidia, the inner surface of the ascidium representing the ventral surface of the leaf, as contrasted with epiascidia, the usual form in which the inner surface is homologous with the dorsal surface of the leaf.

³⁹ DE CANDOLLE, C., Nouvelle étude des Hypoascidies de *Ficus*. Bull. Herb. Boissier II. 2: 753-762. *pls.* 8-9. 1902.

Stomata, corresponding in structure with those of *Ficus bengalensis*, with which they were compared, were abundant on the internal surface of the ascidium, but absent on the external surface, which contains the palisade tissue. Furthermore, the outer surface (the dorsal surface of the leaf) of the ascidium is provided with a hypodermis, which is interrupted here and there by a large cystolith-containing cell, neither of which is found on the inner surface. In addition to the normal form, two leaves were found in which two pouches were formed, one on either side of the midrib, by the coalescing of the inner surface of the ascidium with the midrib along a line opposite to the midrib. The course of the vascular system in both forms is described. Their ontogeny was also studied, the first indication of the formation of an ascidium being found in a leaf about 1.5^{mm} in length, while at a length of 4^{mm} the complete structure was found. The ascidium results from the formation of the lamina completely around the end of the petiole, and corresponds, except that it takes place in an inverse manner, with the development of ordinary epiascidia. As to whether the phenomenon is teratological in nature or whether the trees are to be regarded as representing a distinct species cannot yet be decided. The great age of the phenomenon would be indicated by the legends concerning the miraculous transformation of the leaves of an old banyan (*F. bengalensis*) from which these trees descended.

PENZIG⁴⁰ has also published teratological notes, most of which deal with foliar ascidia. In *Smilax aspera* he describes epiascidia in which the coalescence of the foliar margins occurs toward the apex instead of the base of the leaf. He designates this form as apical epiascidium, in contradistinction to the very common basal epiascidium. Apical epiascidia have hitherto been recorded in teratological literature in *Tulipa Gesneriana*. In *Carica Papaya* he figures and describes a large series of interesting malformations in accessory stalked laminae produced from the center of the leaves. This phenomenon in itself is so rare as to be of great interest, but this interest is greatly increased by the extraordinary conformation of the lamina of the accessory leaf. In the simplest form the leaf is a simple, basal epiascidium; in more frequent cases the modification represents twin ascidia (dipiascidia), that is, one to the right and the other to the left of the midrib. Similar ascidia are frequent in *Saxifraga crassifolia*. The midrib may become free from the ventral surface or extend through the lower somewhat peltate portion of the lamina, bearing above a more or less completely developed ascidium. Several more or less perfectly formed ascidia, sometimes as many as four, may occur on the same midrib, in which case the forms alternate, a hypiascidium following an epiascidium and *vice versa*. The part of the paper dealing with ascidia is illustrated by forty well chosen and executed figures.

DISCHIDIA RAFFLESIANA has attracted the attention of several writers, as Wallich, Griffiths, Beccari, Treub, and Groom. Since 1890 it has been

⁴⁰PENZIG, O., Note di Teratologia Vegetale. Malpighia 16: 164-176. pls. 4-6. 1902.

grown with success at Kew. In 1893 Dr. Scott and Miss Sargent⁴¹ published a study of the pitchers of this plant, basing their observations on the Kew material. Thistleton-Dyer adds a note⁴² based on teratological material, "atavistic forms," as he designates them, which appeared after some ten years cultivation. The pitchers are morphologically leaves, the inner surface corresponding to the lower surface of the normal foliage leaf. The abnormal forms represent a series of transitions from a normal leaf to the pitcher by an increasing concavity of the under surface. The pitchers in the abnormal material differ, however, from the fully developed organ in the open mouth, uninflexed margins, and small size. Unless it be in one case, no indication was found of any such transition stage having been observed in nature. The production of pitchers is not a general characteristic of *Dischidia*, only a small part of the whole number of species having this habit. He considers that there can now be little doubt that the pitchers have as an ancestral form leaves such as those of *D. borneensis* Beec., and *D. collyris* Wall., in which the leaves are convex. He considers that the view of Treub, that the pitchers are water-economizers, corresponds most nearly with the facts, and while it is only in certain cases they collect rain water, under all circumstances they serve to preserve water lost by transpiration. The whole root system of the plant is adventitious and the pitchers are provided with a copious root system derived from one or more of a pair of aerial roots originating from the petiole or the closely adjacent stem. There can be little doubt, he thinks, that the roots utilize the humus contained in the pitchers as if it were ordinary soil, and accepts the suggestion of Groom that the organic matter is brought in by ants. He concludes, then, that there is in this plant a complex adaptation in which the leaves, originally developed for the purpose of storing and economizing water, often imperfectly perform this function and are then taken possession of by ants which supply solid in place of the liquid nutriment.

IN *DIE TROPENPFLANZEN* (6: 389. 1902) there is given a photograph of a "double" Ananas from the Azores. Harshberger⁴³ has recently written of the fasciation in the pineapple from Jamaica, where it seems to be not at all uncommon. Usually the form assumed is fan-shaped, the component fruits being arranged side by side, but sometimes one or more project, forming an irregularly disposed row. The smallest example examined consisted of two united fruits, while the largest, twenty inches across and twelve inches high, was composed of a dozen or more.

⁴¹ Annals of Botany 7: 243-269. pls. 11-12. 1893.

⁴² THISTLETON-DYER, W. T., Morphological notes. VII. Evolution of pitchers in *Dischidia rafflesiana*, Annals of Botany 16: 365-369. pls. 14-15. 1902.

⁴³ HARSHBERGER, J. W., Coxcomb fasciation of pineapples. Proc. Acad. Sci. Philad. 53: 609-611. 1902.

FASCIATION in the sweet potato is the subject of a paper by Conard,⁴⁴ who gives observations on the frequency of occurrence and the form and histology of the formation in its usual type as well as in the interesting condition known as "ring-fasciation." Besides the description of his own material, he refers quite extensively to other forms and to the literature—a virtue in which so many of the teratological papers are sadly deficient.

CARLETON E. PRESTON (Amer. Nat. 36 : 727-734. figs. 10. 1902) considers the foliage of *Acacia* and finds considerable variation in the forms of the pinnate leaves. In the production of the phyllodia he found some forms which, while they may be mere anomalies, might seem to indicate that this organ may not be entirely petiolar in nature, the rachis as well as the petiole being concerned in its formation, and the pinnae dropping from the base or the tip of the central axis.—PENZIG (*loc. cit.*) describes and figures among others an abnormality in the flower of *Gladiolus segetum*. The abnormal example shows a perianth of nine instead of six parts, four instead of three stamens, and a five-parted stigma with an ovary of five carpels instead of the usual number.—COPELAND (BOT. GAZ. 34 : 142-144. figs. 5. 1902) describes and figures abnormal forms of *Asplenium pinnatifidum* Nutt. and *Polypodium vulgare* L. found on the Laurel ridge in northern West Virginia, and suggests that, while they are not necessarily any support for the theory of De Vries as to the origin of new species, the value of the study of such freaks as these in connection with the questions De Vries has raised is self-assertive.—EICHLER (Jahreshefte der Ver. vaterl. Naturk. in Württemberg 58 : LXXI-LXXII. 1902) gives some brief notes of a teratological nature and also some suggestions on xenia and double fertilization.—PERROT (Bull. Soc. Bot. France 49 : 163-166. figs. 6. 1902) publishes observations on the general form and histological structure of excrescences found on the ventral surface of leaves of *Aristolochia Siphon*, and suggests that the excrescences are the result of an effort to increase the transpiration surface. The formations clearly belong to those occurring in various species of plants which have been designated as "seam-like" outgrowths. No reference is made to the literature. The formation has been described for this species by a half-dozen or more writers.—CAMUS figures and very briefly describes (Bull. Soc. Bot. France 49 : 70-71. pl. 1. 1902) monstrosities in *Salix hippophaefolia* Thuill. caused by *Ceidomya rosaria* H. Lev.—PROLIFICATION in the pear, where it has frequently been described, is noted and figured in the *Lyon Horticole* (24 : 81-85. 1902), and proliferation of the fruit of *Capsicum*, a very common occurrence and one which has been three or four times treated in the literature, is figured in a later number of the same journal (24 : 382-385. 1902).—J. ARTHUR HARRIS.

⁴⁴CONARD, H. S., Fasciation in the sweet potato. Contrib. Bot. Lab. Univ. Penn. 2 : 205-215. pl. 19. 1902.

JUEL,⁴⁵ while traveling in Tunis, secured a specimen of the curious parasite *Cynomorium coccineum*, and succeeded in keeping it alive until he had secured material for the entire life-history except the seed and seedlings, and even this gap was filled later from material collected in Trapani. He had thought that a careful study might reveal some such condition as that described by Treub for *Balanophora*, but fertilization and the formation of the embryo take place in the usual manner, as had already been shown by Pirotta and Longo. The behavior of the megaspore mother-cell is peculiar. The two cells resulting from the first division of the megaspore mother-cell are very unequal, the one nearest the micropyle being considerably smaller. This smaller cell divides longitudinally and the larger one transversely, thus giving rise to four megaspores, of which the one nearest the chalaza develops at the expense of the other three. The peculiar arrangement of the four megaspores and their inequality in size are habitual, having been noted in twenty cases. Artificial pollination showed that fertilization takes place four days after pollination; sixteen days after pollination embryos of various sizes were found. The antipodals do not divide, as described by Pirotta and Longo, but may be distinguished as three undivided cells even after the endosperm has become abundant. In the ripe seed the embryo is a small spherical mass of cells with no suspensor and no differentiation into body regions.—CHARLES J. CHAMBERLAIN.

⁴⁵JUEL, H. O., Zur Entwicklungsgeschichte des Semens von *Cynomorium*. Beih. Bot. Centralbl. 13:194-202. *figs. 5*. 1902.